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Annotated Bibliography of the Conch Genus *Strombus* (Gastropoda, Strombidae) in the Western Atlantic Ocean

George H. Darcy

September 1981

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728. Vertical sections of semimonthly mean temperature on the San Francisco-Honolulu route: From expendable bathythermograph observations, June 1966–December 1974. By J. F. T. Saur, L. E. Eber, D. R. McLain, and C. E. Dorman. January 1979, iii + 35 p., 4 figs., 1 table. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 003-017-00438-4.

729. References for the identification of marine invertebrates on the southern Atlantic coast of the United States. By Richard E. Dowds. April 1979, iv + 37 p. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 003-017-00454-6.

730. Surface circulation in the northwestern Gulf of Mexico as deduced from drift bottles. By Robert F. Temple and John A. Martin. May 1979, iii + 13 p., 8 figs., 4 tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 003-017-00456-2.

731. Annotated bibliography and subject index on the shortnose sturgeon, *Acipenser brevirostrum*. By James G. Hoff. April 1979, iii + 16 p. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 003-017-00452-0.

732. Assessment of the Northwest Atlantic mackerel, *Scomber scombrus*, stock. By Emory D. Anderson. April 1979, iv + 13 p., 9 figs., 15 tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 003-017-00450-3.

733. Possible management procedures for increasing production of sockeye salmon smolts in the Naknek River system, Bristol Bay, Alaska. By Robert J. Ellis and William J. McNeil. April 1979, iii + 9 p., 4 figs., 11 tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 003-017-00451-1.

734. Escape of king crab, *Paralithodes camtschatica*, from derelict pots. By William L. High and Donald D. Worlund. May 1979, iii + 11 p., 5 figs., 6 tables.

735. History of the fishery and summary statistics of the sockeye salmon, *Oncorhynchus nerka*, runs to the Chignik Lakes, Alaska, 1888–1966. By Michael L. Dahlberg. August 1979, iv + 16 p., 15 figs., 11 tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 003-017-00459-7.

736. A historical and descriptive account of Pacific coast anadromous salmonid rearing facilities and a summary of their releases by region, 1960–76. By Roy J. Whale and Robert Z. Smith. September 1979, iv + 40 p., 15 figs., 25 tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 003-017-00460-1.

737. Movements of pelagic dolphins (*Stenella* spp.) in the eastern tropical Pacific as indicated by results of tagging, with summary of tagging operations, 1969–76. By W. F. Perrin, W. E. Evans, and D. B. Holts. September 1979, iii + 14 p., 9 figs., 8 tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 003-017-00462-7.

738. Environmental baselines in Long Island Sound, 1972–73. By R. N. Reid, A. B. Frame, and A. F. Draxler. December 1979, iv + 31 p., 40 figs., 6 tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 003-017-00466-0.

739. Bottom-water temperature trends in the Middle Atlantic Bight during spring and autumn, 1964–76. By Clarence W. Davis. December 1979, iii + 13 p., 10 figs., 9 tables. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 003-017-00467-8.

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U.S. DEPARTMENT OF COMMERCE
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Annotated Bibliography of the Conch Genus *Strombus* (Gastropoda, Strombidae) in the Western Atlantic Ocean[1]

GEORGE H. DARCY[2]

ABSTRACT

This bibliography consists of 126 annotated references on the anatomy, biology, behavior, distribution, ecology, economic uses, fisheries and fishing methods, mariculture, physiology, predators, symbionts, systematics, and toxicity of seven species of the conch genus *Strombus* in the western Atlantic Ocean. A subject index is provided.

INTRODUCTION

This bibliography lists the pertinent references concerning members of the genus *Strombus* in the western Atlantic Ocean. Although basically a tropical genus, *Strombus* species occur as far north as North Carolina on the Atlantic coast of the United States, in the Gulf of Mexico, and as far south as Brazil. Seven valid species occur in the western Atlantic and are included in this bibliography: *S. alatus*, *S. costatus*, *S. gallus*, *S. gigas*, *S. goliath*, *S. pugilis*, and *S. raninus*. Of these, *S. goliath* is endemic to Brazil. The remaining species are more widely distributed.

The term "conch" is usually used to refer to strombid gastropods, although it is often applied locally to any large, usually edible, gastropod, and may refer to species belonging to other families such as Melongenidae, Fasciolariidae, and Buccinidae. In the tropical western Atlantic, conch usually refers to *Strombus gigas*, the queen or pink conch. *Strombus gigas* is by far the most economically important strombid in the western Atlantic, being a traditional staple food item in the Bahamas and in many of the Caribbean islands. In addition to its local use as food, the queen conch is an important item of trade; queen conch shells and shell products are often sold as tourist items and the meat is exported to distant markets. Because of their smaller size, the other species of strombids are less economically important, although some, such as *S. costatus*, the milk or harbor conch, are locally used for food to a small extent.

In addition to their economic importance, strombids are of interest ecologically, physiologically, and behaviorally. In searching the literature, references dealing with these subjects were examined and many are included in this bibliography. A few references not specifically dealing with western Atlantic strombids, but of general applicability to strombids, have been included, particularly those on behavior. Subjects covered by references included in this bibliography are listed in the subject index. In general, references merely mentioning *Strombus* species, such as faunal lists, were not included, nor were early taxonomic references.

Arrangement of references is alphabetical by author's surname. Each entry is annotated to further facilitate location of a reference covering a particular area of interest.

ACKNOWLEDGMENTS

I thank Julie Josiek, Librarian of the Southeast Fisheries Center (SEFC) Miami Laboratory, for her help in searching and retrieving literature; D. M. Allen, T. J. Costello, and A. C. Jones of the Office of Fishery Management; George C. Miller, Miami Laboratory; and Lynn M. Pulos, SEFC Editor, for reviewing the manuscript; Ruth Turner, Harvard University, and Donald R. Moore, University of Miami, who suggested several references; and Carl Berg, Marine Biological Laboratory, Woods Hole, Mass., who provided a copy of Alcolado's paper.

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ANNOTATED BIBLIOGRAPHY

ABBOTT, R. T.

1954. American seashells. Van Nostrand Co., Inc., Princeton, N.J., 541 p.

Geographic distributions, shell descriptions, adult sizes, partial synonymies and notes on abundance for *S. pugilis*, *S. alatus*, *S. gigas*, *S. costatus*, *S. raninus*, and *S. gallus*. Photographs provided.

1960. The genus *Strombus* in the Indo-Pacific. Indo-Pac. Mollusca 1(2):33–144.

General account of the genus *Strombus* with remarks on distribution, locomotion, spawning, sexual dimorphism, and morphology and a list of recognized taxa. *Strombus pugilis* is the type of the subgenus *Strombus*. *Strombus alatus* is a distinct species. Mentions fossil members of the subgenus (*Strombus*) from the Caribbean.

1970. American Malacological Union Symposium: *rare and endangered mollusks*. 7. Eastern marine mollusks. Malacologia 10:47–49.

Causes of mortality in marine mollusks. *Strombus gigas* is among the species listed as being overcollected in limited areas.

1974. American seashells. 2d ed. Van Nostrand Reinhold Co., N.Y., 663 p.

Figures of *S. pugilis*, *S. alatus*, *S. gigas*, *S. costatus*, *S. raninus*, and *S. gallus* with notes on ranges, adult sizes, shells, and habitats. Synonyms given.

ADAMS, J. E.

1970. Conch fishing industry of Union Island, Grenadines, West Indies. Trop. Sci. 12:279–288.

Cultural history of Union Island and the development of the *S. gigas* fishery there, with detailed descriptions of fishing grounds and vessels. Effects of weather and currents on fishing discussed. Almost all conch fishing near the island is done by diving, with most of the conchs sold for meat; a few shells are sold to tourists. Marketing and trade of conchs with Grenada and Trinidad described. Limitations of the conch resource, the island's most lucrative commodity, and possibilities of overfishing mentioned.

ALCOLADO, P. M.

1976. Crecimiento, variaciones morfologicas de la concha y algunas datos biologicos del cobo *Strombus gigas* L. (Mollusca, Mesogastropoda). Acad. Cienc. Cuba Ser. Oceanol., No. 34, 36 p.

Extensive study of many aspects of the biology and ecology of *S. gigas* from several localities in Cuba, including habitats, growth rates, length-weight relationships, population densities and structures, maturation sizes and ages, seasonality and effects of the environment on growth, food, shell morphology, sex ratio, nursery and adult habitats, mortality coefficients, locomotion, survival out of water, relationship of animal weight to total weight, and effects of boring sponges on conchs. Growth rates calculated from tagging data and von Bertalanffy relationships. Recommendations for conservation and mariculture. *Strombus raninus* and *S. costatus* mentioned as associates of *S. gigas*.

ANDREWS, J.

1971. Sea shells of the Texas coast. Univ. Texas Press, Austin, Tex., 298 p.

Strombus alatus figured with notes on its mating and occurrence on the Texas coast.

1977. Shells and shores of Texas. Univ. Texas Press, Austin, Tex., 365 p.

Strombus alatus figured with notes on its mating and occurrence on the Texas coast.

ANONYMOUS.

1961. Conch diet may bolster body's defenses against polio. Med. World News, Sept. 15, p. 7.

Conch diet may provide defense against viruses such as polio.

ARNOLD, J. M., and K. O. ARNOLD.

1969. Some aspects of hole-boring predation by *Octopus vulgaris*. Am. Zool. 9:991–996.

Feeding of *Octopus vulgaris* on *S. raninus*, *S. costatus*, *S. gallus*, and immature *S. gigas* under laboratory conditions. A small bore-hole is made in the spire of the conchs, a venom introduced, and the conch animal removed from the shell and eaten.

BAIRD, R. H.

1973. Report to the government of British Honduras on fisheries management and potential. Rep. FAO/UNDP (TA), 3203, FAO, Rome, Italy, 54 p.

Results of a tagging study to determine movements and growth rate of *S. gigas*. A dredge was designed to sample conch stocks in deep water. Natural history of *S. gigas* and effects of a conch quota system and its use to determine future fishing levels described.

BANDEL, K.

1976. Die Gelege Karibischer Vertreter aus den Überfamilien Strombacea, Naticacea und Tonnacea (Mesogastropoda) sowie Beobachtungen im Meer und Aquarium. [In Engl. summ.] Mitt. Inst. Colombo-Alemán Invest. Cient. 8:105–139.

Biological information on 13 species of mesogastropods from the southern Caribbean Sea, including *S. gigas* and

S. pugilis, with notes on locomotion, habitat, and shell morphology. Egg masses described and illustrated.

BARR, L., R. COOPER, R. ELLIS, W. HERRNKIND, I. KOBLICK, and J. VAN DERWALKER.
1971. Ecology and population dynamics of the spiny lobster, *Panulirus argus*, of St. John Island, U.S. Virgin Islands. *In* J. W. Miller, J. G. Van Derwalker, and R. A. Waller (editors), Tektite 2, Scientists in the Sea, p. VI-34-VI-57. U.S. Dep. Inter., Wash., D.C.

Spiny lobster predation on *S. gigas*. A spiny lobster was observed breaking open *S. costatus*.

BERG, C. J., JR.
1972. Ontogeny of the behavior of *Strombus maculatus* (Gastropoda: Strombidae). Am. Zool. 12:427–443.

Results of laboratory studies of larval *S. maculatus*, an Indo-Pacific strombid, and field studies of juvenile *S. maculatus*. Ontogeny of behavior such as locomotion, feeding, shell-righting, and predator-escape responses discussed.

1974. A comparative ethological study of strombid gastropods. Behaviour 51:274–322.

Comparison of the behavior of 10 species of Indo-Pacific strombids (*Strombus* and *Lambis* spp.) including feeding, locomotion, shell-righting, and predator-escape responses. Literature on behavior of strombids reviewed, revealing remarkable similarity among species. Behavioral findings used to speculate on phylogenetic relationships of strombids.

1975. Behavior and ecology of conch (Superfamily Strombacea) on a deep subtidal algal plain. Bull. Mar. Sci. 25:307–317.

Behavior and ecology of several large gastropod species from an algal plain off Puerto Rico, with special emphasis on the strombaceans *S. gallus* and *Xenophora conchyliophora*. Observations on courtship, copulation, egg deposition, escape, feeding, and locomotion of these species are made, predators discussed, and abundance estimates of large gastropods on the plain given.

1976. Growth of the queen conch *Strombus gigas*, with a discussion of the practicality of its mariculture. Mar. Biol. (Berl.) 34:191–199.

Economic importance of *S. gigas* and its exploitation. Presents growth data based on laboratory rearing of conchs through metamorphosis, rearing of juveniles in a mariculture system, measuring size-frequency distributions of natural populations of juveniles, and reanalysis of Randall's 1964 tag-recapture data. Laboratory rearing through metamorphosis briefly discussed. The von Bertalanffy growth equation is used to analyze growth data of mariculturally reared juveniles. Meat yields are correlated with total weights and shell lengths. Longevity is about 6 years, with sexual maturity being reached in about 3 years. An age-specific survivorship curve is derived from Randall's 1964 data. Prospects for mariculture discussed.

BLAKESLEY, H. L.
1977. A contribution to the fisheries and biology of the queen conch, *Strombus gigas* L., in Belize. [Abstr.] 107th Annu. Meet. Am. Fish. Soc., Sept. 15–17, 1977, Vancouver, B.C., p. 12.

Results of a survey of conch populations along the northern barrier reef of Belize with notes on shell length, shell lip development, sex, and sexual maturity. Sex ratio was one to one, with females larger than males. Shell length was not found to be a good indicator of maturity; shell lip development coincided well with maturity. Growth rate and catch per unit effort presented based on data collected, and localized overfishing noted.

BOSS, K. J.
1969. Conchs. *In* F. E. Firth (editor), The encyclopedia of marine resources, p. 135–140. Van Nostrand Reinhold Co., N.Y., 740 p.

Several large gastropods referred to as conchs discussed, with emphasis on strombids. The most extensive conch fishery in the world is that for *S. gigas* in the Caribbean Sea. *Strombus gigas* shells are used in the curio trade and conch pearls in the jewelry trade; other uses of the shells include: porcelain, mortar, horns, tools, ceremonial objects, and cameos. Conch fisheries in the Bahamas and Turks and Caicos mentioned, and conch biology including habitat, life span, sex ratio, spawning, growth, fecundity, and predators briefly reviewed.

1971. Conch fisheries. Annu. Rep. 1970, Am. Malacol. Union, p. 33–34.

Gastropod fisheries discussed, with brief reference to *Strombus* fisheries.

BOWER, W. J.
1945. Egg laying process of *Strombus pugilis alatus* Gmelin. Nautilus 59:35.

Laying of a gelatinous egg string by *S. alatus* in St. Petersburg, Fla.

BREDER, C. M., JR.
1948. Observations on coloration in reference to behavior in tide-pool and other marine shore fishes. Bull. Am. Mus. Nat. Hist. 92:281–311.

Notes on the frequency of occurrence of the conchfish, *Astrapogon stellatus*, with *S. gigas* and *S. samba* (= *S. gigas*) near Bimini, Bahamas.

BROWNELL, W. N.
1977. Reproduction, laboratory culture, and growth of *Strombus gigas*, *S. costatus* and *S. pugilus* [sic] in Los Roques, Venezuela. Bull. Mar. Sci. 27:668–680.

Relative abundances of *S. gigas*, *S. costatus*, *S. pugilis*, *S. raninus*, and *S. gallus* in the Los Roques area. *Strom-*

bus gigas and, to a lesser extent, *S. costatus* and *S. pugilis* are fished commercially, with *S. gigas* being overfished. Spawning, spawning seasons, and egg masses of *S. gigas*, *S. costatus*, and *S. pugilis* described. Spawning is attributed to temperature change. Laboratory hatching and rearing of larvae, including details of phytoplankton food culture and larval development described and metamorphosis time given for *S. gigas*, *S. costatus*, and *S. pugilis*. Yields of cultures and danger periods in development given and food requirements of larvae and juveniles discussed. Newly metamorphosed *S. gigas* illustrated. Growth rates of juveniles of the three principal species are given, with ecological notes on habitats and associated organisms. Provides characters useful in distinguishing between the juveniles of these species, and figures the juveniles. Feasibility of mariculture discussed.

1978. Report on the status of conch fisheries and related research in Belize, Turks and Caicos, Dominican Republic, Antigua, Dominica, St. Lucia, Barbados, Grenada, Trinidad and Tobago, and Venezuela, with notes on three countries not visited (Cuba, Bahamas, and St. Vincent). Inter-regional Project for the Development of Fisheries in the Western Central Atlantic (WECAF), Panama, Sept. 1978, 5 p.

Notes on regulations, demand, prices, marketing, catches, problems, processing capabilities, and fishing methods in conch fisheries in the countries covered. Includes brief comments on conservation and mariculture possibilities.

BROWNELL, W. N., and C. J. BERG.
1978. Conchs in the Caribbean: a sustainable resource? Sea Front. 24:178–185.

General review of biology and fisheries for *S. gigas* in the Caribbean Sea, including life history, development, behavior, growth rate, predators, fishing techniques, and uses of conch meat. Overfishing problems and possibilities of mariculture and stocking of juveniles mentioned.

BROWNELL, W. N., C. J. BERG, JR., and K. C. HAINES.
1977. Fisheries and aquaculture of the conch, *Strombus gigas* in the Caribbean. FAO Fish. Rep. 200, p. 59–69.

Declines in catch rates of *S. gigas* in the Caribbean area, with catch rates for Venezuela, 1969–1975, given. Growth rates of conchs raised in captivity in Los Roques and St. Croix, with probit analysis used to analyze growth rates of the Los Roques conchs. Laboratory rearing of larvae of *S. gigas*, *S. costatus*, and *S. pugilis* discussed. Shell length of juveniles correlated with marketable meat weight. Larval life and metamorphosis discussed. Due to slow growth rates of *S. gigas*, seeding of grassflats with laboratory-reared juveniles may be more feasible than mariculture.

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1949. A new *Strombus* species. Shell Notes 2 (7, 8, 9):106–109.

Description of a new "species," *S. canaliculatus* [= *S. gigas*] from 175 fm, Elbow Key, Bahamas, with illustrations of the shell and details of the channelled spire.

CARRANZA, J.
1962. Survey of the marine fisheries and fishery resources of the Yucatan Peninsula, Mexico. Sc.D. Thesis, Univ. Michigan, Ann Arbor, 193 p.

Yucatan fisheries for the "green" conch, *S. gigas*, particularly the fishery of Quintana Roo. Areas of conch abundance listed. Conch are taken in only small quantities due to lack of markets, although canning may be feasible in the future.

CHADWICK, G. H.
1899. An attempt to define the natural groups of strombs. Nautilus 13:76–78.

Worldwide strombids grouped according to their shell morphologies. *Strombus gallus*, *S. gigas*, *S. goliath*, *S. costatus*, *S. bituberculatus* [= *S. raninus*], and *S. pugilis* included.

CLENCH, W. J., and R. T. ABBOTT.
1941. The genus *Strombus* in the western Atlantic. Johnsonia 1(1):1–15.

Descriptions, synonymies, and distributions of *S. raninus*, *S. gallus*, *S. pugilis pugilis*, *S. p. alatus* [= *S. alatus*], *S. p. nicaraguensis*, *S. costatus*, *S. samba* [= *S. gigas*], *S. gigas*, and *S. goliath*, including a key to these species.

CLIFTON, H. E., C. V. W. MAHNKEN, J. C. VAN DER-WALKER, and R. A. WALLER.
1970. Tektite 1, Man-in-the-Sea Project: Marine Science Program. Science (Wash., D.C.) 168(3932):659–663.

Sonic tags used to follow movements of *S. gigas*. Tagged conchs moved up to 55 m per day, although old individuals moved little. Conchs were usually found in groups of similar-aged individuals.

COMPERE, E. L., JR., and J. M. BATES.
1973. Determination of calcite:aragonite ratios in mollusc shells by infrared spectra. Limnol. Oceanogr. 18:326–331.

Strombus gigas shells primarily aragonitic with traces of calcite in the surface layers.

COOGAN, A. H.
1968. Bahamian and Floridian biofacies. *In* H. G. Multer (editor), Field guide to some carbonate rock environments, Florida Keys and western Bahamas, p. 141–154. Miami Geol. Soc., Miami, Fla.

Major biofacies of the Bahamas and Florida Keys discussed and figured. *Strombus samba* [= *S. gigas*] and *S. costatus* biofacies described, including bottom types and associated organisms.

COOMANS, H. E.
1958. A survey of the littoral Gastropoda of the Netherlands Antilles and other Caribbean islands. Stud. Fauna Curaçao Other Caribb. Isl. 8(31):42–111.

List of gastropods collected in the Caribbean Sea by P. W. Hummelinck, with station localities. Strombids included are: *S. gigas*, *S. costatus*, *S. gallus*, *S. pugilis pugilis*, and *S. raninus*.

1973. Pearl formation in gastropod shells. Sb. Nar. Mus. Praze 29B(1-2):55–64.

Detailed survey of pearl formation in mollusks, including *S. gigas*. Conch pearls are aragonitic and have at times commanded high prices, although their pink color usually fades with time and they are not highly regarded today. Experiments on cultivation of conch pearls have been attempted.

CRAIG, A. K.
1966. Geography of fishing in British Honduras and adjacent coastal areas. La. State Univ. Coast. Stud. Inst. Tech. Rep. 28, 143 p.

Fishing techniques, processing, marketing, and export of *S. gigas* in Belize briefly discussed. Habitat, local distribution, and use of conch shells as concrete are mentioned.

CURREY, J. D., and J. D. TAYLOR.
1974. The mechanical behaviour of some molluscan hard tissues. J. Zool. Lond. 173:395–406.

Test results for shell material from several mollusks, including *S. gigas* and *S. costatus*. Tensile strength, modulus of elasticity, and modulus of rupture values given, and shell structure and material orientation listed.

DALL, W. H.
1889. A preliminary catalogue of the shell-bearing marine mollusks and brachiopods of the southeastern coast of the United States, with illustrations of many of the species. Bull. U.S. Nat. Mus. 37:1–232.

Ranges of *S. gigas*, *S. pugilis*, *S. bituberculatus* [= *S. raninus*], and *S. costatus*.

DALL, W. H., and C. T. SIMPSON.
1900. The Mollusca of Porto Rico. Bull. U.S. Fish Comm. 20:351–524.

Notes on strombids from Puerto Rico, including *S. gigas*, *S. pugilis*, *S. costatus*, *S. bituberculatus* [= *S. raninus*], and *S. gallus*. Synonymies, shell descriptions, sizes, distributions, and notes on the use of conchs by man included.

DAMMANN, A. E.
1969. Study of the fisheries potential of the Virgin Islands. Spec. Rep. Caribb. Res. Inst. 1, p. 1–197.

General description of the fisheries of the U.S. Virgin Islands. Landings, commercial use, local consumption, use as bait, value, and imports of *S. gigas* covered.

D'ASARO, C. N.
1965. Organogenesis, development, and metamorphosis in the queen conch, *Strombus gigas*, with notes on breeding habits. Bull. Mar. Sci. 15:359–416.

Literature describing spawning and larval development in the genus *Strombus* briefly reviewed. Spawning, egg masses, and laboratory rearing of *S. gigas* veligers described. Veliger development presented in detail, with illustrations and histological sections of various larval stages. Planktotrophic development described for veligers 1 to 40 days old, and the swim-crawl stage described for 52 to 60 days. A growth curve for cultured veligers presented and causes of mortality discussed. Food supply is critical to successful culture of the larvae.

1970. Egg capsules of prosobranch mollusks from South Florida and the Bahamas and notes on spawning in the laboratory. Bull. Mar. Sci. 20:414–440.

Egg masses and capsules of *S. gallus* described and illustrated.

DODGE, H.
1956. A historical review of the mollusks of Linnaeus. Part 4. The genera *Buccinum* and *Strombus* of the class Gastropoda. Bull. Am. Mus. Nat. Hist. 111:155–312.

Synonymies presented for *S. gallus*, *S. gigas*, and *S. pugilis*, with extensive discussions of shell forms and variations and names applied to them. The species are compared to other related strombids including *S. alatus*, *S. costatus*, *S. goliath*, and *S. raninus*. *Strombus gigas* forms discussed include *S. g. "horridus"*, *S. g. "canaliculatus"*, *S. g. "verrilli"*, and *S. "samba"*.

DORAN, E., JR.
1958. The Caicos conch trade. Geogr. Rev. 48:388–401.

Distribution and use of conchs in the Caicos Islands, with a brief review of *S. gigas* biology. Historical importance of *S. gigas* in the Caribbean area reviewed. Vessels and techniques used in hooking conchs, cleaning methods, and drying of conch meat described. Conch trade with Haiti discussed, and values of conch exports given for 1904–1956. Importance of the conch trade to the economies of Haiti and the Caicos Islands emphasized, and cultural exchange implications discussed. Freezing conch meat and sending shells to Miami are aspects of the trade begun after 1950.

EPSTEIN, S., and H. A. LOWENSTAM.
1953. Temperature-shell-growth relations of Recent and interglacial Pleistocene shoal-water biota from Bermuda. J. Geol. 61:424–438.

Shell deposition in mollusks from Bermuda correlated with temperature using oxygen isotope analysis. Mean

growth (shell deposition) temperatures given for *S. gigas* and *S. costatus* based on isotope studies.

EVANOFF, V.

1979. Natural baits: conch. Salt Water Sportsman 40(4):111–112.

Brief account of *S. gigas* distribution and use. Use of conch as chum and bait discussed.

FIELD, L. H.

1977. An experimental analysis of the escape response of the gastropod *Strombus maculatus*. Pac. Sci. 31:1–11.

Escape response of the Hawaiian strombid *S. maculatus* to molluscivorous gastropods is described in detail. Adaptive morphology of strombids discussed.

FISCHER, P.

1861. Note sur les organes visuels des *Strombus*. J. Conchyliol. 9:213–220.

General observations and notes on the eye structures and colors of strombids. Eyes of *S. gigas* described in detail, with emphasis on structure.

FISCHER, W. (editor)

1978. FAO species identification sheets for fishery purposes. Western Central Atlantic (Fishing Area 31), Vol. 6, FAO, Rome.

Short synopses of large edible gastropods, including *S. costatus* and *S. gigas*. Pictorial guide to the edible gastropods included and English, French, and Spanish common names, adult sizes, distributions, shell descriptions, and comments on commercial use of *S. costatus*, *S. gigas*, and *S. pugilis* provided. Figures illustrate distinguishing characters of *S. costatus*, *S. gigas*, *S. pugilis*, *S. raninus*, and *S. goliath*. Distribution maps of *S. gigas* and *S. costatus* with notes on present fishing grounds, catches, main fishing gear, and utilization given.

FLORES, C.

1964a. Notas sobre la distribucion geografica e importancia de *Strombus gigas* L., 1758 (Mollusca: Mesogastropoda) en las aguas costeras Venezolanas. Lagena 1964(3):32–34.

Presence of *S. gigas* in grassbeds of Venezuelan coastal waters briefly discussed.

1964b. Contribucion al conocimiento del genero *Strombus* Linnaeus, 1758, (Mollusca: Mesogastropoda), en las aguas costaneras de Venezuela. Mem. Soc. Cienc. Nat. LaSalle 24(69):261–276.

Descriptions and photographs of strombids from Venezuela and offshore islands: *S. gigas*, *S. pugilis*, *S. costatus*, *S. gallus*, and *S. raninus*. *Strombus gallus* and *S. raninus* are new records for Venezuela. Distributions and abundance of the Venezuelan strombids compared. Photographs of adult *S. costatus*, *S. gallus*, and *S. raninus*, as well as growth series of *S. gigas* and *S. pugilis* provided.

FORD, P. D.

1945. An albino *Strombus gigas* Linne. Mollusca (Tavares, Fla.) 1(4):50.

A pure white, fresh shell of *S. gigas* reported from Jamaica.

GILLARY, H. L.

1971. Electrical responses from the mature and regenerating eye of *Strombus*, a marine gastropod. Am. Zool. 11:672.

Abstract on anatomy and function of the eye of *S. luhuanus*, an Indo-Pacific strombid.

1972. The regenerating eye of *Strombus*: anatomy and electrophysiology. Am. Zool. 12:691.

Abstract on anatomy and function of the eye of *S. luhuanus*, an Indo-Pacific strombid.

1974. Light-evoked electrical potentials from the eye and optic nerve of *Strombus*: response waveform and spectral sensitivity. J. Exp. Biol. 60:383–396.

Description of anatomy and electrical responses of the eye of *S. luhuanus*, an Indo-Pacific strombid.

GOODRICH, C.

1944. Variations in *Strombus pugilis alatus*. Occas. Pap. Mus. Zool. Univ. Mich., No. 490, 10 p.

Sanibel Island, Fla., designated the type locality of the "subspecies" *S. pugilis alatus* [= *S. alatus*]. Detailed description and discussion of variation in shell sculpture, size, color, and pattern, with notes on habitat and distribution.

GUDGER, E. W.

1927. Inquilinism between the cheilodipterid fish, *Apogonichthys puncticulatus*, and the univalve mollusk, *Strombus bituberculatus*. Zoologica, N.Y. 9:193–200.

Partial translation of Plate's (1908) description of symbiosis between an apogonid fish, *Apogonichthys* [= *Astrapogon*] *strombi*, and the conch *S. gigas* in the Bahamas. Observations made on a similar relationship between two other species, *S. bituberculatus* [= *S. raninus*] and *Apogonichthys* [= *Astrapogon*] *puncticulatus* from Tortugas, Fla.

GULLAND, J. A. (editor)

1971. The fish resources of the ocean. Fishing News (Books) Ltd., Surrey, Eng., 255 p.

Strombus gigas and *S. costatus* mentioned as molluscan resources of the Central Western Atlantic region. Conch fisheries of the Bahamas and Honduras briefly mentioned. It is suggested that exploitation of conchs is

nowhere intense and increases in production might be possible, but no supporting evidence is given.

GUNTER, G.
1971. The molluscan resources of the Gulf of Mexico. FAO Fish. Rep. 71(2):111–115.

Catches of *S. gigas* from the west coast of Florida mentioned. *Strombus alatus* listed as a potential food resource since it is abundant in certain areas of the Gulf of Mexico, such as off western Louisiana.

HAGBERG, A. H., and C. KALB.
1968. Marine shelled mollusks of commercial importance in Central America. Bol. Tec. 2(2):1–32.

Strombus gigas figured with very brief description of its range, habitat, and fishery.

HESSE, C. O., and K. HESSE.
1977. Conch industry in the Turks and Caicos Islands. Underwater Nat. 10(3):4–9.

History of the *S. gigas* fishery of the Turks and Caicos Islands reviewed, including trade, export, and price of conchs. Fishing methods, catch rates, and conch meat processing discussed, and conch biology briefly reviewed, including growth rates and predators. Recommendations for regulation of the conch industry of the Turks and Caicos Islands listed.

HESSE, K. O.
1979. Movement and migration of the queen conch, *Strombus gigas*, in the Turks and Caicos Islands. Bull. Mar. Sci. 29:303–311.

Results of a study of a *S. gigas* population in the Turks and Caicos Islands. Population densities and age ratios given for the study period. Migrational patterns of conchs discussed, with comments on seasonality and age structure of the migrants. Burying behavior and frequency discussed, as is clumping of adult conchs during winter. Reasons for migration, burying, and clumping of conchs proposed.

HILDEBRAND, H. H.
1954. A study of the fauna of the brown shrimp (*Penaeus aztecus* Ives) grounds in the western Gulf of Mexico. Publ. Inst. Mar. Sci. Univ. Tex. 3:233–366.

Comments on abundance and depth range of *S. alatus* in the northern and western Gulf of Mexico and Campeche Bank.

HORIUCHI, S., and C. E. LANE.
1965. Digestive enzymes of the crystalline style of *Strombus gigas* Linné. I. Cellulase and some other carbohydrases. Biol. Bull. (Woods Hole) 129:273–281.

Results of a study of cellulase activity of the crystalline style of *S. gigas*, with remarks on the role of the enzyme in nutrition of the conch.

1966. Carbohydrases of the crystalline style and hepatopancreas of *Strombus gigas* Linné. Comp. Biochem. Physiol. 17:1189–1197.

Feeding habits of *S. gigas* reviewed and compared with laboratory findings of enzyme activities of cellulases produced by the crystalline style and digestive glands.

HOWELL RIVERO, L.
1945. *Strombus*, molusco hospedero de peces del genero *Apogonichthys*. Rev. Soc. Malacol. "Carlos de la Torre" 3(3):110–112.

Symbiosis between the fish *Apogonichthys* and the strombids *S. gigas* and *S. raninus*, with notes on these associations.

HUGHES, H. P. I.
1976. Structure and regeneration of the eyes of strombid gastropods. Cell Tissue Res. 171:259–271.

Results of experiments involving eye removal and regeneration in *S. gigas*, *S. raninus*, and *S. pugilis*. Structures of the eyes reported, as well as regeneration patterns and rates.

HUMFREY, M.
1975. Sea shells of the West Indies. Taplinger Publ. Co., N.Y., 351 p.

Notes on the range, size, shell color and sculpture, abundance, and habitat of strombids from Jamaica. *Strombus gigas*, *S. pugilis*, *S. raninus*, *S. costatus*, and *S. gallus* figured in color photographs.

IVERSEN, E. S.
1976. Farming the edge of the sea. Fishing News (Books), Ltd., Surrey, Eng., 436 p.

Strombus gigas briefly discussed as a potential species for mariculture. Growth rates and potential predators of conch mentioned. Pen rearing of conchs is recommended, although low prices for whole conchs may make mariculture impractical.

JAVIDPOUR, M.
1978. Fossil *Strombus gigas* from southern Florida. Nautilus 92:102–104.

Fossil *S. gigas* of Pliocene and Pleistocene age from Mule Pen Quarry near Naples, Fla. Fossil specimens described and figured. Bathymetric range and habitat of living *S. gigas* discussed, and other fossil records mentioned.

JOHNSON, C. W.
1934. List of marine Mollusca of the Atlantic coast from Labrador to Texas. Proc. Boston Soc. Nat. Hist. 40:1–204.

Ranges of *S. gigas*, *S. costatus costatus*, *S. costatus iner-*

mis, *S. bituberculatus* [= *S. raninus*], *S. pugilis pugilis*, and *S. pugilis alatus* [= *S. alatus*].

JOHNSON, R. F.
1965. Processes of calcification in *Strombus gigas*. Ph.D. Thesis, Univ. Miami, Coral Gables, Fla., 106 p.

Calcium uptake and deposition in *S. gigas* examined and hypothetical growth rates calculated based on biochemical findings.

JOHNSON, R. F., J. J. CARROLL, and L. J. GREENFIELD.
1964. Some sources of carbonate in molluscan shell formation. Limnol. Oceanogr. 9:377–384.

Results of laboratory experiments on carbonate uptake by *S. gigas*. Radioactively tagged amino acids and inorganic carbonates found to be utilized in shell formation. Other metabolic byproducts of carbonate deposition mentioned. Shell growth rates are correlated with physical activity of *S. gigas*.

JUNG, P.
1971. *Strombus gigas* Linnaeus from the Bowden Formation, Jamaica. Nautilus 84:129–131.

Fossil specimen of *S. gigas* from Jamaica described and illustrated. Other known fossil specimens mentioned.

LEEHMAN, E.
1971. *Strombus goliath* Schröter. Hawaiian Shell News 19(6):12.

Strombus goliath from off Salvador, Brazil, described and a photograph presented.

LITTLE, C.
1965. Notes on the anatomy of the queen conch, *Strombus gigas*. Bull. Mar. Sci. 15:338–358

Results of a study of the external morphology and internal anatomy of *S. gigas*, with emphasis on the vascular, excretory, and digestive systems. Detailed anatomical drawings provided.

1967. Ionic regulation in the queen conch, *Strombus gigas* (Gastropoda, Prosobranchia). J. Exp. Biol. 46:459–474.

Results of laboratory analysis of the composition of the haemolymph of *S. gigas*, with physiological observations on ion transport in the conch. Pericardial, kidney, and stomach fluids and mantle cavity mucus are analyzed for composition and probable mode of action.

LONG, G. A.
1973. Shell trumpets and concentric circles in Pre-Columbian tomb offerings. [Abstr.] Bull. Am. Malacol. Union 1972, p. 8–9.

Use of *S. gigas* and other large gastropods for ritualistic purposes in the Americas prior to the Spanish Conquest.

MANNING, R. B., and H. E. KUMPF.
1959. Preliminary investigation of the fecal pellets of certain invertebrates of the South Florida area. Bull. Mar. Sci. Gulf Caribb. 9:291–309.

Fecal pellets of *S. gigas* described.

McGINTY, T. L.
1946. A new Florida *Strombus*, *S. gigas verrilli*. Nautilus 60:46–48.

A form of *S. gigas* resembling young *S. costatus* in its early growth stages described from a mangrove area of Lake Worth, Fla. Photographs and detailed shell descriptions are provided, pointing out differences between *S. g. verrilli* and typical *S. gigas* and *S. costatus*. Notes on habitat and behavior.

MENZEL, R. W.
1969. The possibility of molluscan mariculture in the Caribbean. FAO Fish. Rep. 71(1):156.

Mariculture potentials of several Caribbean mollusks. *Strombus gigas* could merit attention but may not be a feasible animal for mariculture due to its life history.

1971. Possibilities of molluscan cultivation in the Caribbean. FAO Fish. Rep. 71(2):183–200.

Biology of *S. gigas* briefly reviewed. Conch mariculture may be possible with increased knowledge of the food requirements of the larvae. Rearing of conchs in fenced areas and stocking of juveniles mentioned.

MILLER, S. E.
1972. Relationships between type of locomotion, size, and speed in larger gastropod molluscs. [Abstr.] *In* G. J. Bakus (editor), Marine studies on the north coast of Jamaica, p. 5. Atoll Res. Bull., No. 152.

Strombus gigas reported to move by leaping, which is the fastest form of locomotion studied. Speed is directly proportional to size in *S. gigas*.

MORICE, J.
1958. Animaux marins comestibles des Antilles Françaises. Rev. Trav. Inst. Peches Marit. 22:85–104.

List of strombids from the French Antilles: *S. pugilis*, *S. bituberculatus* [= *S. raninus*], *S. gallus*, and *S. gigas*, with notes on their abundance and use in the Lesser Antilles.

NEWELL, N. D., J. IMBRIE, E. G. PURDY, and D. L. THURBER.
1959. Organism communities and bottom facies, Great Bahama Bank. Bull. Am. Mus. Nat. Hist. 117:179–228.

Descriptions of *S. costatus* and *S. samba* [= *S. gigas*] communities on the Great Bahama Bank, with notes on floral and faunal assemblages and bottom types.

NOWELL-USTICKE, G. W.
1959. A check list of the marine shells of St. Croix U.S. Virgin Islands with random annotations. G. W. Nowell-Usticke, Christiansted, St. Croix, U.S. Virgin Is., 90 p.

Strombids from St. Croix listed with notes on their abundance, distribution around the island, and shell color and morphology. Species and forms listed are: *S. raninus*, *S. raninus nanus*, *S. gallus*, *S. pugilis*, *S. costatus*, *S. costatus spectabilis*, *S. samba* [= *S. gigas*], *S. gigas*, and *S. gigas verrilli*.

OLSSON, A. A., and D. R. MOORE.
1962. A neglected west Atlantic stromb. Nautilus 75:127–128.

Short note on a strombid, *S. "canaliculatus"* [= *S. gigas*], named by Leo Burry in 1949 from the Bahamas. The finding of three additional specimens is reported, and an adult specimen, designated a topotype, is figured and described.

OPRESKO, L., R. THOMAS, and F. M. BAYER.
1976. A guide to the larger marine gastropods of Florida, the Gulf of Mexico, and the Caribbean region. Sea Grant Field Guide Ser., Univ. Miami, No. 5, 55 p.

Synopses of *S. pugilis*, *S. alatus*, *S. gigas*, *S. costatus*, and *S. raninus*, including recognition features, size, geographical range, habitat and depth range, economic importance, synonyms, and comparisons to other species. Each species is figured, although the figures of *S. raninus* and *S. costatus* are reversed. Recipes for *S. gigas* used in salad, fritters, steaks, and chowder provided.

PARKER, G. H.
1922. The leaping of the stromb (*Strombus gigas* Linn.). J. Exp. Zool. 36:205–209.

Locomotion of *S. gigas* described in detail.

PERCHARDE, P. L.
1968. Notes on distribution and underwater observations on the molluscan genus *Strombus* as found in the waters of Trinidad and Tobago. Caribb. J. Sci. 8:47–55.

Detailed notes on locomotion, burying behavior, movements, egg-laying, habitat, local distribution, and abundance of *S. pugilis*, *S. raninus*, *S. gigas*, *S. costatus*, and *S. gallus* in the area of Trinidad and Tobago. Maps show collection sites of strombid species in the area of study.

1970. Further underwater observations on the molluscan genus *Strombus* Linne as found in the waters of Trinidad and Tobago. Caribb. J. Sci. 10:73–81.

Seasonal reproductive and activity patterns of *S. pugilis*, *S. raninus*, and *S. gigas*, with notes on sex segregation, oviposition, and sex ratios. Predators of *S. raninus* include the fish *Batrachus surinamensis* and the cephalopod *Octopus vulgaris*. Notes on occurrence of *S. gallus*. Photographs of *S. gallus*, *S. raninus*, *S. alatus*, *S. pugilis*, *S. gigas*, and *S. costatus* included.

1974. A comparison of the *Strombus* (Mollusca) colonies, of two southern Caribbean islands - Trinidad and Grenada. Seventh Caribb. Geol. Conf., St. François, Guadeloupe, 30 June - 12 July, 1974, Sect. 5, Symp. 2: Caribbean reef systems. Paper 17, 1 p.

Ecological differences between *Strombus* colonies in Grenada and Trinidad briefly discussed. Colonies are found deeper in Grenada, where water temperature is higher and light penetration is greater than in the continental-type waters of Trinidad. Caution in interpretation of paleoecological evidence is urged.

PERRY, L. M., and J. S. SCHWENGEL.
1955. Marine shells of the western coast of Florida. Paleontol. Res. Inst., Ithaca, N.Y., 318 p.

General introduction to the genus *Strombus*, with comments on feeding, shell morphology, and locomotion. *Strombus pugilis alatus* [= *S. alatus*] described in detail, including notes on abundance off the southwest coast of Florida, and the presence of egg masses. The adult is figured. Occasional occurrence of *S. gigas* and *S. costatus inermis* on the beaches of Sanibel and Captiva Islands mentioned.

PETUCH, E. J.
1972. *Morum dennisoni* Reeve (Gastropoda: Cassidae) and *Strombus costatus* Gmelin (Gastropoda: Strombidae) collected off the North Carolina coast. Veliger 15:51–52.

Range extension of *S. costatus*. Four specimens were dredged off Cape Fear, N.C., at a depth of 25 m.

PLATE, L.
1908. *Apogonichthys strombi* n. sp., ein symbiotisch lebender Fische von den Bahamas. Zool. Anz. 33:393–399.

Description of a new species of fish, *Apogonichthys strombi*, with notes on its association with *S. gigas* in the Bahamas.

PRESCOTT, B., and C. P. LI.
1966. Antimicrobial agents from sea food. Malacologia 5:45–46.

Extracts from mollusks including *S. gigas* increase defensive mechanisms of test animals to microorganisms such as viruses.

PYBAS, D. W., and F. LAWLOR.
No date. Fish facts for Florida consumers—conch. Fla. Sea Grant Mar. Advis. Prog. MAFS-23.

Brief popular account of the history of *S. gigas* fishing and utilization. Includes notes on preparation of conch meat and six recipes using conch.

RANDALL, J. E.

1963. Monarch of the grass flats. Sea Front. 9:160–167.

Uses of *S. gigas*, including prices and landings of conchs in the Bahamas in 1959, types of vessels and gear used in hooking conchs, and holding and processing methods. Dangers of depletion through overfishing mentioned.

1964a. The habits of the queen conch. Sea Front. 10:230–239.

Semipopular report on conch tagging and growth studies in St. John, U.S. Virgin Islands. Predators of *S. gigas* which crush or swallow the entire animal include eagle rays, hogfish, triggerfish, porcupinefish, and permit. Other fish appear to consume only soft parts of conchs. Invertebrate predators of conchs include octopus, tulip shells, and horse conchs (*Pleuroploca*). The most important invertebrate predator is a large species of hermit crab. Spiny lobsters, tiger sharks, and loggerhead sea turtles are also implicated as predators. Egg masses and egg deposition of conchs described and a fecundity estimate made. Geographical differences in conch size are noted, as are changes in shells with age. Old conchs have caused illness in humans and may be ciguatoxic.

1964b. Contributions to the biology of the queen conch, *Strombus gigas*. Bull. Mar. Sci. Gulf Caribb. 14:246–295.

Results of a detailed study of the biology and ecology of *S. gigas* in St. John, U.S. Virgin Islands. Economic importance of the queen conch in the Caribbean reviewed. Synonyms and forms of *S. gigas* (e.g., *S. canaliculatus*, *S. gigas horridus*, *S. samba*) discussed, and *S. gigas* distinguished from other Caribbean strombids. Shell growth and repair examined. Length-weight and volume-weight relationships, sexual dimorphism in size, and sex ratios also examined. Habitats of the conch in St. John mentioned. Growth rates based on a tagging study are presented along with notes on locomotion and movements. Results of a food study indicate that *S. gigas* is herbivorous. Egg masses are described, fecundity estimates made, and spawning behavior and seasonality noted. A detailed study of predators presented, and commensals of *S. gigas* reviewed.

1965. Grazing effect on sea grasses by herbivorous reef fishes in the West Indies. Ecology 46:255–260.

Feeding of *S. gigas* on the sea grasses *Thalassia* and *Cymodocea* and on epiphytic algae mentioned.

1967. Food habits of reef fishes of the West Indies. Stud. Trop. Oceanogr. Inst. Mar. Sci. Univ. Miami, No. 5, p. 665–847.

Reports *S. gigas* from the stomachs of the fishes: *Aetobatis narinari, Epinephelus striatus, Trachinotus falcatus, Lutjanus analis, Lutjanus griseus, Lutjanus jocu, Ocyurus chrysurus, Haemulon plumieri, Haemulon sciurus, Balistes vetula*, and *Diodon hystrix*. *Strombis gallus* is also reported from *Aetobatis narinari*.

RIOS, E. C.

1970. Coastal Brazilian seashells. Fund. Cidade Rio Grande, Mus. Oceanogr. Rio Grande, Rio Grande, Brazil, 255 p.

Range, habitat notes, and Brazilian records for *S. costatus*, *S. gallus*, *S. goliath*, *S. raninus*, and *S. pugilis*. Adults of these species are figured, as are the juveniles of *S. goliath* and *S. pugilis*.

1975. Brazilian marine mollusks iconography. Fund. Univ. Rio Grande, Cent. Cienc. Mar, Mus. Oceanogr., Rio Grande, Brazil, 331 p.

Range, habitat notes, Brazilian records, and shell dimensions for *S. pugilis*, *S. costatus*, *S. gallus*, *S. goliath*, and *S. raninus*. Adults are figured.

ROBERTSON, R.

1959. Observations on the spawn and veligers of conchs (*Strombus*) in the Bahamas. Proc. Malacol. Soc. Lond. 33:164–171.

Spawning of *S. costatus*, *S. raninus*, and *S. gigas* in the Bahamas described. Egg masses of these three species are described, and the egg strings of *S. raninus* and *S. gigas* figured. Fecundity estimates given. Information regarding rates of development of embryos in the laboratory and notes on the veliger stages of these species provided. Observations made on the "samba" form of *S. gigas*, with comparisons to typical *S. gigas*.

1961. The feeding of *Strombus* and related herbivorous marine gastropods: with a review and field observations. Not. Nat. (Phila.), No. 343, 9 p.

Review of the literature on feeding of strombids. *Strombus gigas*, *S. costatus*, and *S. raninus* feeding habits in Bimini, Bahamas, described based on field and aquarium studies. Detailed comments on habitat and food items are made, with notes on escape responses of *Strombus* to tulip shells (*Fasciolaria* spp.). *Strombus alatus* and *S. pugilis* feeding studies in Florida are also reported, with descriptions of feeding behavior, food items, and fecal pellets. The strombid species studied are concluded to be herbivores. The "samba" form of *S. gigas* sometimes causes ciguatera in the Bahamas, perhaps due to its algal diet.

1962. The status of *Strombus canaliculatus*. Nautilus 75:128–130.

Validity of *S. canaliculatus* as a distinct species is questioned. *Strombus canaliculatus* proposed to be a malformation of *S. gigas*, possibly due to mantle injury. The spire of the topotype of *S. canaliculatus* figured and compared to a drawing of the spire of the holotype.

SANDER, F., and E. A. MOORE.

1978. Comparative respiration in the gastropods *Murex pomum* and *Strombus pugilis* at different temperatures and salinities. Comp. Biochem. Physiol. 60A:99–105.

Respiratory response of *S. pugilis* to different temperatures and salinities was monitored. *Strombus pugilis* is a stenohaline osmo-conformer which does not expend extra energy below or above its optimum salinity range (about 33–37‰).

SANGSTER, A. W., S. E. THOMAS, and N. L. TINGLING.
1975. Fish attractants from marine invertebrates. Arcamine from *Arca zebra* and strombine from *Strombus gigas*. Tetrahedron 31:1135–1137.

Isolation and characterization of strombine, an extract from *S. gigas*, described and synthesis of strombine hydrochloride explained. Dilute amounts of strombine are sufficient to elicit feeding behavior in fish in aquaria.

SCHROEDER, W. C.
1924. Fisheries of Key West and the clam industry of southern Florida. Rep. U.S. Comm. Fish. Fiscal Year 1923, append. xii, p. 1–74.

Brief account of the *S. gigas* fishery of Key West, with notes on volume and value of the catch, fishing methods, preparation, and marketing. Danger of overfishing conchs mentioned.

SCOFFIN, T. P.
1970. A conglomeratic beachrock in Bimini, Bahamas. J. Sediment Petrol. 40:756–759.

Role of *Strombus* shells and shell fragments in the formation of beachrock.

SHOEMAKER, A. H.
1971. *Strombus* range extensions. Nautilus 85:72.

Range of *S. raninus* is extended to off Wilmington, N.C., (23 m depth) and that of *S. gigas* to off Georgetown, S.C. (25 m depth).

SIGEL, M. M., L. L. WELLHAM, W. LICHTER, L. E. DUDECK, J. L. GARGUS, and A. H. LUCAS.
1970. Anticellular and antitumor activity of extracts from tropical marine invertebrates. *In* H. W. Youngken, Jr. (editor), Food-drugs from the sea, proceedings 1969, p. 281–294. Mar. Technol. Soc., Wash., D.C.

Strombus gigas extracts indicated to have positive antitumor activity.

STEVELY, J. M.
1979. The biology and fishery of the queen conch (*Strombus gigas*): a review. *In* Proc. Fourth Annu. Trop. Subtrop. Fish. Technol. Conf. Americas, p. 203–210. Texas A&M Univ. Sea Grant Coll. Prog., TAMU-SG-80-101.

Brief review of the literature of *S. gigas*, including information on economic importance, biology, distribution, life history, age and growth, pearl formation, fisheries and fishing methods, processing, landings, and values. Importance of the resource in the Caribbean is stressed, with notes on increasing fishing pressure and possible management options.

TELFORD, M., and C. DAXBOECK.
1978. *Porcellana sayana* Leach (Crustacea: Anomura) symbiotic with *Strombus gigas* (Linnaeus) (Gastropoda: Strombidae) and with three species of hermit crabs (Anomura: Diogenidae) in Barbados. Bull. Mar. Sci. 28:202–205.

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